Xerox Docket No. D/A1591D

PATENT APPLICATION

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re the Application of

Jingkuang CHEN et al. Group Art Unit: 2813

Application No.: 10/727,692 Examiner: Nema A. Berezny

Filed: December 4, 2003 Docket No.: 111517.01

For: SYSTEMS AND METHODS FOR INTEGRATION OF HETEROGENEOUS CIRCUIT DEVICES

DECLARATION UNDER 37 C.F.R. §1.131

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

We, Jingkuang Chen and Yi Su, hereby declare and state that:

1. This Declaration is submitted as evidence that the invention of this application was invented by us prior to March 14, 2001, which is the effective filing date of U.S. Patent No. 6,546,798 to Waters et al., entitled "Micro-Electro-Mechanical Systems Resonant Optical Gyroscope," which was applied in the April 11, 2005 Office Action.

2. We are the named inventors in the above-identified application.

3. We are the inventors of the invention described in an invention proposal entitled "An IC Process For Integration Of CMOS With Lateral DMOS Photodiodes For Visible Lights," which appears as Exhibit A attached to this Declaration. The invention proposal is signed by us and dated February 23, 2001.

4. The copies of these pages which constitute Exhibit A are true copies of the invention proposal.

5. The invention described by Exhibit A was conceived and actually reduced to practice by us in the United States at least as early as February 23, 2001.

6. We were in possession of the invention recited in claims 1, 3-14 and 17-21 as evidenced by the entire disclosure of Exhibit A.

7. We hereby declare and state that all statements made herein of our own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Date: June 27, 2005 Jingkuang Chen

Jingkuang Chen

Date: _____

Yi Su

Attachment:
Exhibit A

Xerox Docket No. D/A1591D

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4. The copies of these pages which constitute Exhibit A are true copies of the invention proposal.

5. The invention described by Exhibit A was conceived and actually reduced to practice by us in the United States at least as early as February 23, 2001.

6. We were in possession of the invention recited in claims 1, 3-14 and 17-21 as evidenced by the entire disclosure of Exhibit A.

7. We hereby declare and state that all statements made herein of our own knowledge are true, and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine and/or imprisonment under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing therefrom.

Date: _____ _____
Jingkuang Chen

Date: 6/24/05 _____
Yi Su

Attachment:
Exhibit A

THE DOCUMENT COMPANY
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Invention Proposal

IPA10283

Signed hard copy To: Xerox Intellectual Property Law Department

☒ Xerox Square -20A, Rochester, NY 14644, MailStop XRX2-20A - Send electronic version to your mgr. & copy to: USA.IPLD.MC@mc.usa.xerox.com

☐ El Segundo,CA, 1990 Xerox Centre Dr. 90245, MailStop ESC1-275 -Send electronic version to your mgr. & copy to: USA.IPLD.ES@mc.usa.xerox.com

☐ Palo Alto, CA, 3333 Coyote Hill Road 94304, MailStop: PARC - Send electronic version to your mgr. & copy to: USA.IPLD.PA@mc.usa.xerox.com

☐ Wilsonville,OR, 26600 SW Parkway 97070, MailStop: 7063-LAW Send electronic version to your mgr. & copy to: USA.IPLD.OR@mc.usa.xerox.com

	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	Outside Phone No.
1	**Jingkuang Chen** MSML		983673	(716) - 422-2136
	Organization (Unit/Div./Dept./Section)	Electronic Mail Address	Bldg. No./ Mail Stop	Fax No.
	WCRT/MS&ML/MEMS	**jchen@crt.xerox.com**	**147-16C**	
	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	Outside Phone No.
2	**Yi Su**		X-06253	(716) 422-5018
	Organization (Unit/Div./Dept./Section)	Electronic Mail Address	Bldg. No./ Mail Stop	Fax No.
	WCRT/MS&ML/MEMS	**Syi@crt.xerox.com**	114-41B	
*3	Proposal Submitted By (Please use legal name) Full First Name, Middle, Last		Employee No.	Outside Phone No.
				(__) - ___-____
	Organization (Unit/Div./Dept./Section)	Electronic Mail Address	Bldg. No./ Mail Stop	Fax No.

* If space for additional submitters is required, please use another sheet; and attach any supplementary Comments.

Manager	Electronic Mail Address	Bldg. No./MS
Joel Kubby	jkubby@CRT.Xerox.com	147-16A

Technical Category (see attached list) 3.17, MEMS Devices

Name of Xerox Program (if any) ATP/Optical MEMS

Opportunity for licensing revenue Who could be interested in it? How is this better than alternatives? Higher level of integration

Optoelectronics companies, optical MEMS companies, MEMS companies

Descriptive title of invention

An IC Process for Integration of CMOS with Lateral DMOS and photodiodes for Visible Lights

Describe the problem How was this problem tackled before your invention?

Integration of low-voltage CMOS circuits with high voltage DMOS drivers and photodiodes is of critical importance in implementing MOEM systems for telecommunication and many other applications. Before because of lack of such a technology, different IC chips (photodiodes, CMOS signal processing circuits, high voltage drivers) have to be wired bonded into an optical system to achieve the function of optical-electrical signal conversion/processing and control MEMS actuators. Such approached normally suffers from bulky size, inaccuracy, and high cost.

Summary of the invention Describe briefly what the invention is and how it works in 5 –8 lines.

This invention describes an IC process that monolithically integrates low voltage CMOS circuits with high voltage DMOS drivers and photodiodes for visible wavelength.

The following process flow will be disclosed to our ATP partner standard MEMS. They have certain licensing rights to the process as described in the ATP Collaborative Agreement

Witnessed and Understood By	Date
Joel Kubby	2/23/01
Submitter(s) Signature(s)	**Date**
Jingkuang Chen Yi Su	2/23/01

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Describe your invention Describe how to make and use the invention and its novel embodiments. Cover the process, method, materials with sketches, flow charts, usage etc. What are the advantages of your invention for Xerox?

CMOS/DMOX/Photodiode Integration

Step	Description	Specifications	Target
1	**Substrate**	4", <100>, p-Si, Boron doped, 1.0 x 10E15/cm3 (10-20 ohm-cm) (start with 18 device wafers)	
	Scribe wafers for splits on a)HV n well implant, a1 and a2 b)p-body implant, b1, b2,b3 c)p-body annealing c1, c2, c3		
2	**Prefurnace clean** (add 3 monitoring wafers)	Standard RCA clean	
3	**masking oxide growth for well Implantation**	C2, DWD/TCA (DWDSKIN) Grow skin oxide: 800 degree C, 1 hr, dry 02	
	*add one monitor wafers	1100 degree C, 5-5-70-5-5 (set-dry1-wet/tea-dry2-N2anneal) TCA: LoN2=30sccm Standard ramp: Ramp up:10 degree C/min Ramp down:max Upgas:N2-3 Downgas:N2-3	7000 angstrom
	Inspect thickness (Ellipsometer)		
4	**mask #1, HV n-well**	a) bake 110 degree C, 15 min. b)HMDS, 4.0K, 30 sec. c)AZ 1813, 4.0K, 30 sec, 1.3um d)softbake, 90 degree C, 30 min e)expose, 5.0mW/cm2, 12 sec f) develop MF319, 1 min g)rinse DI water 5 min, spin dry h)hardbake 110 degree C, 15 min.	
5	**Etch Oxide**	BHF, 7-8 min DI water rinse, 5 minutes spin dry	1060 angstrom/min

Witnessed and Understood By	Date 2/23/01
Submitter(s) Signature(s) Jinghong Chen Yi Sin	Date 2/23/01

6 **Ion Implant High voltage n-well** (leave PR on during implantation) (add two monitoring wafers in the ion implantation)	two splits: 2.5e12/sq, Phos, 90keV	
7 **Strip photoresist**	a)Hot PRS 2000, 30 minutes (check under microscope) b)rinse in DI water for 5 min, spin dry	
8 **Mask #2, LV n-well**	a) bake 110 degree C, 15 min. b)HMDS, 4.0K, 30 sec. c)AZ 1813, 4.0K, 30 sec, 1.3um d)softbake, 90 degree C, 30 min e)expose, 5.0mW/cm2, 12 sec f) develop MF319, 1 min g)rinse DI water 5 min, spin dry h)hardbake 110 degree C, 30 min.	
9 **Etch Oxide**	BHF, 7-8 min DI water rinse, 5 minutes	1060 angstrom/min
10 **Ion Implantation Low voltage n-well** (add one blank monitoring wafer)	8.0e12/sq on ALL wafers	
11 **Strip photoresist**	a)Hot PRS 2000, 30 minutes (check under microscope) b)rinse in DI water for 5 min, spin dry	
12 **Prefurnace Clean**	Standard RCA clean	
13 **Screen Oxide growth**	Wet Oxide, 1050 degree C	2000 angstrum
14 **Mask #3, P-well**	a) bake 110 degree C, 15 min. b)HMDS, 4.0K, 30 sec. c)AZ 1813, 4.0K, 30 sec, 1.3um d)softbake, 90 degree C, 30 min e)expose, 5.0mW/cm2, 12 sec f) develop MF319, 1 min g)rinse DI water 5 min, spin dry h)hardbake 110 degree C, 30 min.	
15 **Etch Oxide**	BHF, 9-10 min	

Witnessed and Understood By	Date 2/23/01
Submitter(s) Signature(s) Jugfang Chen Qi Sin	Date 2/23/01

	DI water rinse, 5 minutes (hydrophobic)	1060 angstrom/min
16 **p-well implant** (add one n-type blank monitor wafer)	p-well ion implantation, boron, 7e12/sq, 50keV	
17 **well drive in** (put in the monitoring wafers from step 6, 10, 12)	1200 degree C, 300 minutes 80%N2, 20%O2 standard ramp (measure sheet resistance of the monitoring wafers)	
18 **strip oxide**	BHF etch, 10 minutes DI water rinse, 5 minutes spin dry	hydrophobic
(Start of LOCOS)		
19 **Prefurnace clean** (add two monitor wafers)	standard RCA clean	
20 **Pad oxide growth**	C2, DWD/TCA (DWDSKIN) 900 degree C, 5-17-10.5-5-5 TCA: LoN2=25sccm (inspect oxide thickness)	500 angstrom
21 **LPCVD Nitride Deposition** (put in the monitor wafers from step 17)	C4,CVD NITR (CVD) 820 degree C (check latest dep rate)	1200 angstrom
22 **mask #4, active**	photolithography process, AZ1813	
23 **Etch nitride**	RIE, check etch rate ***(do not strip photoresist)***	
24 **channel stop implant**	Borob, 2e12/sq, 150keV	
26 **strip photoresist**	strip photoresist, hot PRS 2000, 30 min DI water rinse, 5 minutes spin dry	
27 **Prefurnace clean** **(add 2 monitor wafer)**	standard RCA clean	
28 **Field Oxidation**	C2, DWD/TCA (DWDSKIN)	

Witnessed and Understood By	Date 2/23/01
Submitter(s) Signature(s) Dingy Chen Yi Sun	Date 2/23/01

	5-5-4:00-5-0.30, 1000 degree C TCA:LoN2=30sccm standard ramp	1.15um
(inspect oxide thickness of monitor wafers)		
29 **Remove oxide on nitride**	BHF, 30 seconds DI water rinse, 5 minutes spin dry	
30 **strip nitride**	hot phosphoric acidacid at 180 degree C DI water rinse 5 minutes,spin dry	100 angstrom/min
31 **Etch pad oxide** **(END of LOCOS)**	BHF, 30 seconds DI water rinse, 5 minutes, spin dry	
32 **Prefurnace clean** (add one monitor wafer)	Standard RCA clean	
33 **Sacrificial oxide growth**	1000 degree C	950 angstrom
34 **Threshold adjust implantation**	Boron, 2e12/sq, 50 keV, blanket implant	
35 **Strip oxide**	BHF dip, 70 seconds DI water rinse, 5 minutes, spin dry	hydrophobic
36 **Prefurnace clean** (add three monitor wafers)	standard RCA clean	
37 **Grow gate oxide**	C2, DA1 (oxidize) 950 degree C, 35 minutes in dry O2/2%HCL (check uniformity and thickness)	350 angstrom
(GO STRAIGHT to LPCVD poly tube)		
38 **Deposit CVD poly** (GO STRAIGHT to B3)	C3, low poly (CVD)	6000 angstrom
39 **Dope poly**	a)Arsenic implant 5e15/sq, 70 keV b)Anneal poly, 900 degree C, 30 minutes, O2	
40 **Deglaze**	BHF, 60 seconds DI water rinse 5 minutes, spin dry	
(check poly sheet resistance)		

Witnessed and Understood By	Date 2/23/01
Submitter(s) Signature(s) Jeffrey Chen Yi Su	Date 2/23/01

41	**Mask # 5 Poly**	AZ1813
42	**Etch poly**	RIE, rotate wafers during etch
43	**Strip photoresist**	Hot PRS 2000, 30 minutes DI water rinse 5 minutes, spin dry
44	**mask #6 pbody**	photolithography, AZ 1813
45	**pbody implant** (add three monitor wafers)	Boron, 3 splits b1)2.0E13/sq, 100keV
46	**strip photoresist**	Hot PRS2000, 30 minutes DI water rinse 5 minutes, spin dry
44	**Prefurnace clean**	standard RCA clean
45	**pbody anneal**	1150 degree C inert with 1%O2, 200 minutes
46	**Mask #7 Nplus**	photolithography, AZ1813
47	**Phosphorus source/drain implant**	Phosphorus, 4.0e15/sq, 70keV
48	**Strip photoresist**	hot PRS2000, 30 minutes DI water rinse 5 minutes, spin dry.
49	**Mask #10 Pplus**	photolithography, AZ 1813
50	**p+ source/drain implant**	Boron, 1e15/sq, 50keV
51	**Strip photoresist**	Hot PRS 2000, rinse in DI water for 5 minutes
52	**Prefurnace clean** (add one monitor wafers)	standard RCA clean
53	**Deposit PECVD oxide**	5000 angstrom
54	**Anneal**	900 degree C, 30 minutes, inert gas with 1% O2 standard ramp
55	**Mask #9 Via1**	photolithography, Az 1813
56	**Open contact holes**	RIE + BHF

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Submitter(s) Signature(s) Jgbing Chen Yi Su	Date 2/23/01

57 **Strip photoesist**	Hot PRS 2000, rinse in DI water for 5 min	
58 **BHF dip**	30 seconds, 3 minutes DI water wash, spin dry	
59 **Sputter Al**	Al+1/2% silicon	9000 angstrom
60 **mask #9 metal**	photolithography process	
61 **Dry Etch Al**		
62 **Strip photoresist**	Hot PRS 2000. Rinse in DI water	
63 **Pre-alloy clean**	5 minutes acetone, hot 5 minutes IPA, hot 3 minutes DI water rinse N2 gun dry	
64 **Sinter**	A1, Anneal-2 (Anneal-1) N2/H2: 90%/10% 450 degree C, 25 minutes	

Witnessed and Understood By	Date 2/23/01
Submitter(s) Signature(s) Jeffrey Chen Yi Shi	Date 2/23/01

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People List names of others known to have worked on this or a similar invention

None

Related concepts Check the Xerox Patent data base at http://comip.wrc.xerox.com/comip/icbuhome.nsf
What have you found in a data base search of the topic? Give patent or IP number of the most relevant items.

None

Prototype Has a model, a prototype, or experiment of the invention been built, made, run or tested ? ☒ Yes ☐ No

Fabrication run in progress in 201/IJ5BU

Xerox product Is the invention used by Xerox or is there a definite plan for use in a future product(s) ? ☐ Yes ☐ No
If so, please identify the program(s) or product(s), and introduction dates:

Not currently planned for a product program.
Could be used in the future for MEMS Jet

Disclosures Has this concept been disclosed to vendors, consultants, outside parties, partners, etc? Indicate the date(s) of any previous or planned future disclosure external to Xerox, and identify the type of disclosure (by agreement, demonstration, paper or presentation given, market probe, published article, etc., and if convenient, please provide a copy of the agreement, paper or article):

Concept will be disclosed to Standard MEMS, Inc. as a part of our ATP proposal

Outside funding ☒ YES (Indicate Source of outside funding) ☐ NO

Research performed as a part of NIST Cooperative Agreement Number: 70NANB8H4014

Witnessed and Understood By	Date 2/23/01
Submitter(s) Signature(s) Jeffrey Chen Yi Su	Date 2/23/01

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Patent Management Technical Categories

IPA10283

(Touch the hi-lighted areas to receive a definition of the category.)

Architecture and Document Services

1.1 Advanced Print Services
1.2 Document Access & Management
1.3 Document Capture & Analysis
1.4 Document Systems Architecture
1.5 Electronic Document Commerce
1.6 Networked Document Systems
1.7 Productivity Initiatives
1.8 Process, Workflow, Information Management
1.9 Smart Design & Service
1.10 Work Process Analysis

Digital Imaging

2.1 Capture
2.2 Presentation
2.3 Manipulation
2.4 Representation
2.5 Systems

Marking & Devices

3.1 Latent Image Formation (Re-Imageable Process)
3.2 Development (Re-Imageable Process)
3.3 Image Transfer & Fixing (Re-Imageable Process)
3.4 Erase And Cleaning (Re-Imageable Process)
3.5 Fixed Image Marking (Incl. Direct To Plate)
3.6 Imager (ROS, Optics, Modulator, Illumination)
3.7 Thermal Ink Jet
3.8 Acoustic Ink Jet
3.9 Continuous Ink Jet
3.10 On Demand Powder
3.11 Other Direct Marking
3.12 Controls & Diagnostics (For Marking Systems)
3.13 Media Handling (Feeding, Transport, Finishing)
3.14 Marking System Integration & Architecture
3.15 Marking Hybrid Processes
3.16 Display Devices
3.17 MEMS Devices
3.18 Data Recording Devices
3.19 Digital Image Scanning

Materials & Materials Manufacturing

4.1 Toner, Developer and Components (For Re-Imageable Process)
4.2 Photoreceptors and Components
4.3 Dielectric Receivers
4.4 Inks For Direct Marking
4.5 Powders For Direct Marking
4.6 Substrate Media (Paper, Transparencies, etc.)
4.7 Electronic Materials (Light Emitting Or Detecting, Semiconductors For Printhead Or Other Use)
4.8 Display Materials
4.9 Materials for Fusing
4.10 Drum And Belt Substrates
4.11 Materials for Binding and Finishing
4.12 Materials of Controlled Conductivity
4.13 Transfix Belt
4.14 Intermediate Transfer Belts
4.15 Magnetic Materials
4.16 Recording Media
4.17 Packaging Materials

Manufacturing Technology & Product Elements

5.1 Component Development
5.2 Manufacturing Processes
5.3 Production Systems
5.4 Industrial Design / Human Factors
5.5 Device Electronics
5.6 Product Packaging

Speculative Research

6.1 Document Futures
6.2 Applications outside Defined Xerox Direction

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Manager's Comment Section

IPA10283

Submitter(s): Jingkuang Chen & Yi Su

Title of Invention: An IC process for Integration of CMOS with Lateral DMOS & Photo diode

Manager's Name: Joel Kubby

Date: 2/23/01

1. Problem addressed or function provided by the invention:

Example 1A: Finisher cost reduction

Example 1B: Uses low cost LCD to write annotation messages

Microelectronic integrat ion with MEMS devices

2. Central thrust of the invention:

Example 2A: Design incorporates fewer parts

Example 2B: Uses low cost LCD to write annotation messages

Design leads to higher levels of integrat ion for optical MEMS devices

3. Could invention have impact beyond current description?

Example 3A: Could also function for printer finisher

Example 3B: Could also function to erase/edit copy

Could also be used for MEMS et control electronics

4. Potential for Xerox application. Specify product or technology program if possible:

Example 4A: Mainline approach in Program Q

Example 4B: Adds significant feature to future products

not currently outlooked for a Xerox product program.

5. Value to competitors; potential for license or trade:

Example 5A: Enables much lower cost finishing than any known system and opens possibilities of moving finishing down-market

Example 5B: Could be licensed in a business area un-related to Xerox

Lowers cost by higher levels of integration

6. Please indicate any related patents, publications, or activities you know of:

None

7. I would recommend the following form(s) of protection: ☒ Patent ☐ Defense publication ☐ Keep trade secret ☐ None

Comments: